

Remarks In Response To The Outstanding Office Action

Applicant acknowledges the Examiner's approval of the Drawings submitted July 30, 2003.

Claims 1-58 stand pending the present application.

With reference to the specification and claims generally, applicant provides the following general comments considered useful to better understanding thereof. Applicant believes these general comments along with the more specific reply to the Examiner's outstanding Office Action, as set forth below, will support a more productive examination.

The phrase "data scaling" as it appears in claim 1 and elsewhere in the patent application refers broadly to methods for numerically representing or measuring data. Data can be scaled or measured at different measurement levels or scale types with qualitative (quantitative) data corresponding to weaker (stronger) levels. In general, the scale-type of a data set can effect what conclusions can be meaningfully derived from the data. The term "meaningful" is used in a technical (i.e., measurement theory) sense; the basic idea being that conclusions drawn from data should not be affected by different but equally acceptable ways of scaling or measuring the data. An example will clarify this idea. Consider the statement: "It was 20°F last night and is 40°F now so it is twice as warm now as last night." Although the statement appears to say something useful about comparative temperatures, it is actually a meaningless statement. If we convert the temperature measurements to the equally acceptable Celsius scale, the statement is no longer true. (See p. 6, lines 23-26 of specification.)

A slightly more complicated example indicates how considerations of meaningfulness relate to merging or aggregation of scaled data. Suppose a website bookseller A received ratings scores from three customers of (2,2,2) while bookseller B received scores (1,1,3). Suppose, further, that the customer ratings contain relative magnitude information only; that is, a score of 2 is better than a score of 1, a score of 3 is

better than a score of 2, and so on. Which bookseller received the higher aggregate rating? If we compute the mean score, bookseller A has the higher aggregate score. However, since only the order of the rating scores matters, a different, but equivalent way of presenting the data is for A to have the same scores, but B's scores to be (1.6, 1.6, 3). These are equivalent scores since the relative order of all the scores is unchanged. Now, however, B has a higher mean score than A. Since these two results are inconsistent, we conclude that the mean is not a meaningful way to determine the relative size of aggregate ratings. (See also p. 7, lines 28-29 and p. 8, lines 1-16 of specification.)

In general, real world data sets are not homogeneous with respect to scale type; that is, they may contain data with a number of different measurement levels. For example, customer ratings data may be combined with data representing the number of items sold, or the dimensions of an item and its weight. Meaningful analysis and synthesis of such mixed measurement level data often proceeds via a 'lowest common denominator' approach in which higher measurement level information is ignored and the entire data set is analyzed or synthesized at the level of the weakest or lowest scale data element. This approach may result in information loss. (See p. 8, lines 18-28.)

Embodiments of the present invention include an iterative, i.e., approximate, method for scaling (or scale conversion) of data including mixed scale-type data. Input is measured or numerically encoded data containing one or more scale types. This data may arise from physical measurements such as measurements of length or weight, or may be the result of less tangible measurement or scaling procedures such as numerical encodings of human preferences, ratings, and rankings. Embodiments of the invention process the measured data through admissible geometrization (an iterative approach to metric embedding of data reviewed below) to produce data that has been approximately converted to ratio scales. Here, the data is considered "approximately converted" because admissible geometrization is an iterative procedure for fitting data into geometric configurations. Embodiments of the invention also include an iterative method for merging data including mixed scale-type data, where, again, input is measured or

numerically encoded data containing one or more scale types, while output are iteratively merged scaled values.

Turning now to the Examiner's comments in the outstanding Office Action, Claims 1-58 stand rejected under 35 USC Section 101 as allegedly directed to non-statutory subject matter, specifically as not being directed to a final result that is "useful, tangible and concrete."

As stated in the cited Guidelines:

The claimed invention as a whole must be useful and accomplish a practical application. That is, it must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "real world" value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation or research {citations omitted}.

Applicant respectfully submits that the present claims are in fact directed toward practical applications and possess real world value, thereby meeting the requirement that the claimed invention be limited to real world value. In particular, a better understanding of the terms of art employed in the claims will highlight the practical and useful results obtained under the present invention.

Data scaling is, broadly, the process of assigning numbers to empirical (i.e., real world) entities or phenomena. (See, for example: Borg, I. and Groenen, P., *Modern Multidimensional Scaling: Theory and Applications*, Springer, New York, 1997; de Leeuw, J. and Heiser, W., "Theory of multidimensional scaling," in P. R. Krishnaiah and L. N. Kanal, Eds., *Handbook of Statistics*, Vol. 2. North-Holland, New York, 1982; Narens, L., *Theories of Meaningfulness*. Lawrence Erlbaum, Mahwah, New Jersey, 2002; Roberts, F. S., "Limitations on conclusions using scales of measurement," in S. M.

Pollock et al., Eds., Handbooks in OR & MS, Vol. 6, Elsevier, New York, 1994; Stevens, S. S., "On the theory of scales of measurement," Science, 103, 1946, pp. 677-680; and references cited therein.) The numerical output of a data scaling process is called scaled data. Among other things, the present invention claims a novel data scaling process by which real world data is iteratively (approximately) scaled so that the output of this iterative data scaling process is interpretable as scaled data.

Thus, "scaled data" is a term of art referencing empirical – real world – data.

As reviewed above, the present invention provides a novel process for iteratively converting received qualitative and mixed qualitative/quantitative real-world data into quantitative (ratio scale type) data, thus greatly enhancing the usefulness of the received data. For example, analysis and synthesis of ratio scale output data as provided by the present invention has the practical effect of avoiding information loss associated with direct, lowest scale-type analysis and synthesis of mixed qualitative/quantitative data.

All independent claims include or have been amended to include reference to "scaled data." Interpretation, i.e., use thereof in valuation of empirical, i.e., real world entities or phenomena is thereby implicitly claimed and as such by definition the claims all make reference to real world phenomenon or entities, i.e., may by interpretation as such present "useful, tangible and concrete" effect.

Applicant respectfully submits that the claimed subject matter thereby presents practical application and satisfies the requirements of 35 USC Section 101.

Dependent claims 18 and 43 have been amended to more specifically define "received data" in terms of real world received data which, in combination with reference to scaled data, clearly establish a final practical result that is "useful, tangible and concrete."

Applicant respectfully submits that the claims herein do not merely perform an abstract calculation, but rather connect to real world representations and applications with useful and practical results.

Accordingly, the rejection of claim 1-58 under 35 SC Section 101 may be withdrawn.

Claims 1-58 stand rejected under 35 USC Section 112 as allegedly failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner finds unclear what applicant means by the terms “admissible geometrization” and “admissible transformed.” The Examiner has in the outstanding Office Action dated February 2, 2006 interpreted the term “admissible geometrization” as meaning “geometric” and the term “admissible transformed” as meaning “transformed” and has required that applicant provide further clarification and explanation.

Applicant respectfully notes that the Examiner has misinterpreted these terms, and provides the following clarification and explanation with reference to portions of the Specification and cited references therein.

An admissible transformation g is defined as an element of a scale group G (p. 7, lines 5-6; in specification). Given a measurement scale f with scale group G (or, equivalently, having scale type G), an admissible transformation of f is a function $g \in G$ such that the composition $g \circ f$ is also a measurement scale with scale group G . The idea is that there may be many acceptable ways to form a measurement scale and these equally acceptable (i.e., admissible) ways are related, and hence classified, by admissible transformations. A simple example of an admissible transformation for temperature measurements (interval scale type, p. 7, lines 6-8) is the function that converts between Fahrenheit and Celsius temperature scales $g(x) = (5/9)x - 160/9$ (see also p. 7, line 25).

The phrase “admissible transformation” is a term of art in the field of measurement theory (see references cited p. 6, line 15 and p. 7, lines 20-22).

In the application specification and claims, the terms “admissible” and “admissibly” pertain to the concept of admissible transformation and should be so interpreted.

The examiner’s interpretation of “admissible geometrization” as “geometric” is not consistent with the meaning of this term as disclosed in the specification. For example, as disclosed in one embodiment of the invention admissible geometrization refers to an iterative process whereby: (1) Doubly partitioned received data is encoded as weights or lengths on the edges of one or more complete graphs (p. 9, lines 28-29; p. 10, lines 1-4) where these edge weights or lengths are known up to admissible transformation (p. 7, lines 5-6). (2) The complete graph encodings of the doubly partitioned received data are iteratively converted to constrained, energy minimizing configurations of points in an N -dimensional Euclidean space (p. 10, lines 16-22). This two-step embodiment of admissible geometrization is summarized by the diagram $\Gamma_k \rightarrow X_k \rightarrow \mathbf{R}^N$ (p. 11, lines 1-5) where Γ_k denotes the k -th data graph and X_k is the corresponding constrained least energy configuration of points contained in the Euclidean space \mathbf{R}^N .

Step 2 of admissible geometrization in the preferred embodiment of the invention includes minimization of the energy functional E_p (p. 10, line 18), said minimization including the step of admissibly transforming doubly partitioned received data. As disclosed in the specification, minimization of E_p is implemented in one embodiment of the invention through an iterative 2p-IDMDS algorithm (p. 13, lines 5-24). Step 6 of this algorithm involves computing transformed values $g_l(c_{ijl})$ where g_l denotes an admissible transformation from the scale group G_l associated to the l -th subset of the second partition (p. 9, lines 18-21) of the doubly partitioned received data. In one embodiment of the invention, after convergence of the 2p-IDMDS algorithm said transformed data values are output and interpreted as scaled input data values. These admissibly transformed values $g_l(c_{ijl})$ (or sets of values $g_l(C_l)$, see p. 14, lines 3-5) are referred to in the specification alternatively as: “admissibly transformed data elements” (p. 14, line 3), “admissibly transformed values” (p. 38, line 6; p. 40, line 25), and “transformed values”

(p. 14, line 4). In the measurement theory literature, these are also called “pseudo-distances” (p. 14, line 11) or “disparities” (p. 12, line 7).

The Examiner’s interpretation of the term “admissibly transformed” as “transformed” is not consistent with the meaning of this term or any of its synonyms as disclosed in the specification and reviewed above.

Accordingly, in light of the above clarification and explanation, applicant respectfully submits that the rejection of Claims 1-58 under 35 USC Section 112 may be withdrawn.

Claims 1-58 stand rejected under 35 USC Section 102 as allegedly anticipated by Chen US No. 6,684,206 B2.

Chen discloses a method and system of analyzing web access. In particular, Chen discloses a method for “processing of very large, very sparse data cubes” (col. 1, lines 66-67) where these data cubes pose “serious scalability and performance challenges” (col. 2, lines 6-8). According to Chen, “The present invention provides a scalable data warehousing and OLAP-based engine for analyzing web log records (WLRs) that overcomes scalability and performance challenges...mechanisms are provided...for tackling scalability issues related to web access analysis and for dealing with very large, sparse cubes.” (col. 3, lines 59-65).

Cubes are data structures composed of cells where each cell is identified by one element value from each of a possible plurality of dimensions. Cubes can encode measures of Web access. For example, Chen discloses that their invention “can measure Web access in terms of volumes and probability distributions, which are expressed in the form of data cubes” (col. 6, lines 41-43). Chen also discloses a number of methods for designing data cubes to enhance scalability of OLAP analysis of WLRs. (Further discussion of Chen’s data cubes and their relationship to the present invention as presently claimed is given below.)

Respectfully, applicant suggests that the Examiner has misinterpreted both the present invention as presently disclosed and claimed as well as the disclosure of Chen with regards to the measurement-theoretic background and context of the present invention as presently claimed.

The Examiner argues that Chen teaches a “data scaling method” (p. 5). Chen teaches a method for improving “data scalability” for web access analysis. As described above, Chen identifies the “serious scalability and performance challenges” presented by “very large, very sparse data cubes” (col. 2, lines 5-7). Data scalability as taught by Chen refers to the ability to apply data processing and analysis techniques adequate for data sets of a certain size to data sets of a (much) larger size. Embodiments of the present invention disclose a data scaling method based on measurement theory concepts. As disclosed in the specification, data scales are defined as sets of measurement functions or representations (p. 6, line 26). Data scaling refers to the construction or definition of data scales.

“Data scaling” as disclosed and presently claimed is a term well-known to those of ordinary skill in the art and has a separate and distinct meaning from the “data scalability” described by Chen. Chen is silent concerning the measurement-theoretic definition of data scaling disclosed and claimed in the present application and as such cannot support a 35 USC Section 102 rejection of claims 1-58.

The examiner further argues that Chen teaches “(b) forming two partitions of the received data: (col. 4, lines 60-67)” (p. 5). Chen discloses: “The web access analysis mechanism 150 generates one or more summary cubes 160.” Chen’s summary cubes do not partition the web access data. A partition, as disclosed in the present specification, is a disjoint union of data subsets that exhaustively cover the entire data set (p. 9, line 19). Summary cubes do not cover the entire web access data set. To the contrary, the goal of a summary cube is to provide a parsimonious, non-exhaustive representation of the web access data set.

Chen's data cubes are data structures without metric or distance information. In this sense, data cubes are not geometric structures. In contrast, embodiments of the present invention include a method (admissible geometrization) whereby implicitly geometric information (weighted complete graphs) is made explicitly geometric (through iterative embedding in a metric space). Chen's data cubes describe neither complete graphs nor the associated embedded geometric configurations as disclosed and claimed in the present application.

The Examiner further argues that Chen teaches "(c) applying admissible geometrization to the doubly partitioned received data to produce admissibly transformed data (col. 5, lines 18-26; col. 9, lines 50-67 to col. 10, lines 1-12)" (p. 5). Chen discloses aspects of a "scalability enhancement module" (col. 5, lines 18-26), and "high-profile cubes" to "achieve further data reduction" (col. 9, lines 36-38). As discussed above, Chen teaches "data scalability" which is distinct from the measurement-theoretic data scaling process of the presently claimed invention.

For these separate reasons at least, the cited passages from Chen do not describe or anticipate the invention as presently claimed and cannot support a 35 USC Section 102 rejection thereof.

The Examiner further argues that Chen teaches "(d) interpreting the admissibly transformed data as scaled data (col. 9, lines 50-67 to col. 10, lines 1-12)." Again, Chen teaches "data scalability" not measurement-theoretic data scaling. Chen also does not describe or anticipate, in the cited passages or elsewhere, the concept of admissible transformation or the use of this concept as described under embodiments of the present invention and as presently claimed.

The Examiner further argues that regarding claim 2, "Chen teaches wherein the received data comprises one or more scale types (col. 9, lines 50-67 to col. 10, lines 1-12)." Scale types as disclosed and claimed herein and as known to those of ordinary skill

in the art are not described or anticipated in the cited passages or elsewhere in Chen and as such Chen cannot support a 35 SC Section 102 rejection.

The examiner further argues that regarding claim 3, “Chen teaches wherein...(b2) associating a scale type to each subset of a partition of the received data” (col. 9, lines 35-67 to col. 10, lines 1-12).” Scale types as disclosed according to embodiments of the present invention and as presently claimed herein are not described or anticipated in the cited passages or elsewhere in Chen.

Again, Chen cannot support a 35 SC Section 102 rejection.

Chen does refer to “measures” (col. 9, line 53) of hit counts and “the ratio of average counts per element of dimension...” (col. 9, lines 54-55). Chen assumes that data can include measurements and that ratios can be formed from measurements. However, Chen does not associate a scale type to measured data. Chen does not assert, for instance, that data cube measures are ratio scales, or, equivalently, have ratio-scale type. Instead, Chen uses the term “ratio” to refer to the formation of a fraction or an arithmetical division and does not thereby describe or anticipate the measurement-theoretic concept of ratio scale type as disclosed and claimed herein.

Thus, given a better understanding of applicant’s disclosure and claims as further clarified and explained herein and given a better understanding of the disclosure of Chen as provided herein, applicant respectfully submits that the disclosure of Chen, while possibly appearing relevant based on its inclusion of certain words, falls far short of anticipating applicant’s claimed invention.

Accordingly, the rejection of Claims 1-58 as allegedly anticipated by Chen must be withdrawn.

In light of the above remarks, applicant respectfully requests reconsideration and withdrawal of all rejections as presented in the outstanding Office Action.

Respectfully submitted,

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